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Territorial inequalities and convergence – techniques and analysis methods

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Abstract:

The subject proposed in the present research paper is frequently debated and analysed, both at political level and at theoretical and practical level, the opinions and beliefs of the experts being sometimes contrary, but mostly reaching a common denominator: the cohesion and regional development represents for the Member States and for Romania an opportunity for supporting national economy re-launch, diminishing development inequalities and achieving economic and social convergence at territorial level.

Therefore, the presentation of theories, techniques and methods for evaluating and interpreting the convergence process can be a useful approach, both for the academic environment and for the stakeholders.

Key-words: territorial convergence, regional development, economic and social inequalities

JEL Classification: R10, R11, R15

Abstract:

Subiectul propus în prezentul articol este deseori dezbătut și analizat, atât la nivel politic, cât și la nivel theoretic/practic, opiniile și convingerile experților fiind uneori contrare, dar de cele mai multe ori ajungându-se la un numitor comun: coeziunea și dezvoltarea regională reprezintă pentru statele membre și pentru România o oportunitate de a sprijini relansarea economiei naționale, diminuând inegalitățile de dezvoltare și obținând convergența economică și socială la nivel teritorial. Prin urmare, prezentarea teoriilor, tehnicilor și metodelor de evaluare și interpretare a procesului de convergență poate fi o abordare utilă, atât pentru mediul academic, cât și pentru părțile interesate.

Cuvinte-cheie: convergența teritorială, dezvoltare regională, inegalități economice și sociale

Clasificare JEL: R10, R11, R15

INTRODUCTION

In general, the concept of *inequalities* (*discrepancy, disparity, imbalance*, etc.) is used both by analysts, theoreticians, and practitioners in order to express differences identified with the help of some adequate mathematical techniques by using specific indicators or indices.

Related to a certain context, the concept presents more facets being accompanied also by other elements supporting it: convergence, polarisation, agglomeration, concentration, dispersion, etc. As a rule, the evaluation manner of the level or degree of disparity is determined by:

- the territorial dimension to which the relation is established (regional sub-regional, national, over-national, etc.);
- the time period of the regional analysis.

While the theoretical approaches regarding regional inequalities tend to focus on detailed analyses about the nature of income differences within a territory during a period of time, the literature regarding convergence envisages the catching-up process of the poor countries against the rich ones.

The role of space (territory) was relatively recent acknowledged in the literature regarding regional convergence, while older approaches about territorial imbalances were characterised by a relative silence about complications that the regional level might have.

The analysis of regional inequalities turned indeed important especially in the last two decades this thing being visible preponderantly in the increased number of empirical studies regarding convergence (S. Rey, M. Janikas, 2005¹).

The empirical studies about convergence and economic growth can be divided into two large distinct categories:

1. *Studies of substantiating some growth theories*, which lead to building econometric equations estimated based on observing the economy at various levels, including the regional one.
2. *Exploratory studies that apply innovative techniques* with the purpose of generating some hypotheses related to the dynamics of the economic system.

Article presents synthetically the main theoretic approaches that had as main objective the analysis of the dynamic of regional imbalances and convergence.

Theoretic approaches of regional convergence

In general, the notion of convergence is frequently used within comparative economic analyses regarding economic integration with the purpose of identifying the evolutions of some entities (national, sectorial, regional) against a milestone considered as the most performing one, or at a medium level.

The studies regarding convergence have in view the way in which factors involved in a certain process (integration, globalisation, etc.) act for diminishing inequalities between analysed entities. The diminishment of inequalities presupposes bringing closer the values of established performance indicators and ensuring diminishment of gaps within the development level of respective entities.

In specialised literature (A. Iancu, 2008, 2009) there can be identified three types of convergence specific to some fields of application:

1. *Real convergence* that pursues eliminating gaps between countries or regions within the development level given by the income per capita and labour productivity.
2. *Nominal convergence* applied in the field of monetary policy and which refers to obtaining economic stability and switching to the Euro.
3. *Institutional convergence* presupposes rendering compatible the institutions from the viewpoint of structures and functioning.

¹ Sergio J. Rey and Mark Janikas (2005), Regional convergence, inequality, and space, *Journal of Economic Geography*, 2005, vol. 5, issue 2, 155-176.

In general, theoretical approaches regarding regional convergence have focused on the catching-up process: less developed regions make considerable efforts to catch up with rich regions.

The main trends of the current convergence process – *agglomeration and dispersion* – are analysed and interpreted within some recent approaches of regional theory:

1. *Theory of endogenous growth* (R. Lucas, P. Romer, P. Nijkamp);
2. *New economic geography* (P. Krugman);
3. *Institutional theory* (W.R. Scott, P. Dimaggio, W. Powell).

1. The theory of endogenous growth pays attention to the concentration degree of some economic activities as result of the growth effect of the scale profit from investments realised in human capital and research-development. According to the theory, concentration of the mentioned factors in central areas and not in the peripheral ones represents the outcome of an economic integration process. The proposed models, including those based on innovation (Schumpeter's growth theory) considered the efficient, adjustment changes and much less adjustment of optimum allocations from certain locations, being focused on integration and trade. Economic growth at regional level takes place based on amplifying the innovation-learning-knowledge-assimilation process corresponding to labour force. This process presents significant spatial implications up to the moment when transaction costs corresponding to transferring knowledge elements remain very high (P. Romer, 1986; R. Lucas, 1988; L. Fontagne, M. Freudenberg, D. Ünal-Kesenci, 1999; G.M. Grossman, E. Helpman, 1991; P. Aghion, P. Howitt, 2005).

2. The theory of the new economic geography considers the following hypothesis: regional clusters represent the effect of agglomeration phenomena of some forces on certain fields between which important relations are given. In agreement with this theory, the high transport costs protect companies on small markets. Once transportation costs decrease, an increase of competition between companies takes place and, finally, a decrease in forces dispersion. The theory emphasises in particular market integration, economies of scale, transportation costs, and local markets, promoting the combined effects of economic concentration in the centre of the region with the advantages obtained on labour force market and from advanced technologies localisation (P. Krugman, 1991; M. Fujita, A. Venables, 1999).

3. Within the institutional theory, the key-element of one region's development is represented by institutions that establish the technological barriers of economic functions' hierarchies. The reason is given by the fact that these institutions can control the ability of the economy to use and develop own resources in a particular manner. Whenever the institutional capacity is unequally distributed in space, the institutional factor contributes to agglomeration of economic activities strengthening concentration of more advanced activities into most developed areas. An important particularity of these institutions is that they facilitate innovation, research-development, business support, and all these are known as "*innovative systems*" (B. Lundvall, 1992; R. Nelson, 1993).

Within the above-mentioned theoretical approaches, polarisation of economic activities represents a slow, inevitable and convergent process in terms of GDP per capita. At regional level is acknowledged the importance of the measures and political actions required to ensure balance between agglomeration forces and tendencies (concentration).

G. Myrdal (1957) is the first to propose and promote within the regional theory the concept regarding the circular and cumulative cause of economic processes which explains the increase in international differences for the development level against initial similar conditions. By capital movements, migration and commercial exchanges of goods and services are perpetuated and even increased international and regional inequalities. By trade liberalisation, less developed regions, lacking human capital and innovative technologies are obliged to specialise in goods manufacturing, especially primary goods with inelastic demand (low elasticity) in relation to price and income. Developed regions turn into attraction poles and absorb increasingly larger quantities of capital and labour force from less developed regions.

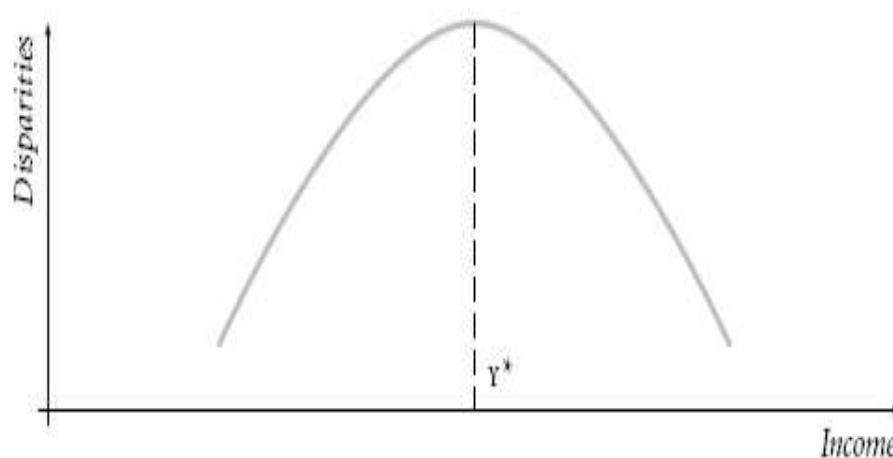
Neoclassical theories, even if they anticipated the unconditioned convergence process on long-term (convergence club), did not succeed in clarifying the basic conditions that might influence the diminishment of regional inequalities (including those from periods of crisis, recession, etc.). Despite all efforts realised in the direction of reforms proposed within the integration process, still a natural, universally valid trend is found of processes' polarisation which leads, finally, to deepening regional divergences.

Already in 1956, J. Williamson considered that in the convergence process inter-regional relations, mobility factors and public policies interact in favour of main agglomerations. Thus, swifter increases within growth poles (for instance, region-capitals) determine a growth in the level of inequalities at regional level. In a more advanced stage of development, regional inequalities can be reduced at a higher aggregate level as compared to incomes. The distribution effect consists in the emergence of agglomeration diseconomies (the high cost of labour force or the congestion effect) and may continue with the growth poles. Hence, regions remaining behind in some countries can benefit from technologies diffusion². There are several economists who consider that New Member-States can be framed within the process entitled "catching-up".

The relationships between growth of national economies and regional imbalances can be graphically represented with the help of a reversed U-shaped curve (Williamson's curve)³. The New Member-States of the European Union find their place on the ascending side of the curve, while old Member-States are placed on the flattened side⁴.

On the curve traced by Williamson, this category of countries register increases of regional inequalities, fact that makes them to be represented on the left side of income Y from Figure 1.

Figure 1: Williamson Curve



Source: Williamson, J. (1965), „Regional inequality and the process of national development: a description of the patterns”, *Economic Development and Cultural Change*, vol. 13.

In conclusion the new approaches regarding convergence at territorial level have as their focus the following aspects:

- *Increasing importance of intangible factors* (including economic policies) in the process of more marked regional inequalities; also, the investment process associated with innovation, research, and development of human capital capacities and abilities represent growth sources of inequalities between regions.

² Lackenbauer, J. (2004), *Catching-up, Regional Inequalities, and EU Cohesion Policy: The Case of Hungary*, p. 5.

³ Williamson, J. (1965), “Regional inequality and the process of national development: a description of the patterns”, *Economic Development and Cultural Change*, vol. 13.

⁴ Prof. Dipl. Eng. František Turnovec CSc, *Regional Inequalities in the EU*, www.ies.fsv.cuni.cz.

- The new approaches bring completions and updates to old methods proposed by the neoclassic theory, by *extending the area of the research object, of the used methods and techniques* and, in particular, by modern methods of computing and processing with the assistance of computer science and programming.
- Also, *a more reality-anchored interpretation of regional economies* is noticed; these economies are included into the convergence process (both from the viewpoint of speed, and also from the perspective of growth rates).

Synthesising, it is found that from the viewpoint of theoretical approaches, regional convergence attracted with it comments and critics alike that contributed to the development of this field of wide interest. Still, despite contributed developments, it cannot be talked yet about a magic formula to stipulate exactly the solution or solutions, through which convergence of some regional structures is ensured, regions that are characterised by a high diversity both from the viewpoint of differing development conditions (natural, human, infrastructure, innovative structures, etc.), traditions, mentalities, and from the perspective of differing rates of economic growth.

Influence factors

In the last decades, and in particular after the emergence of some large areas of political and economic power, inequalities and regional convergence are two concepts capturing the attention of all those interested in the process due to the following considerations:

- *From an academic perspective* –the studies regarding regional inequalities and, in particular, the ones regarding convergence represent indirect methods of testing the validity of various theories and approaches regarding economic growth and international trade;
- *From the practical viewpoint* –knowledge about regional inequalities represents a political priority in the majority of the over-national integration schemes, the more so as their persistence is considered as a negative impact factor on the integration process in itself.

Regional approaches were focused preponderantly on existing inequalities at the level of incomes (total GDP and per capita) attempting to provide viable answers related to the process and trends of economic growth at spatial level. From this perspective, very important is the way in which are selected and processed the territorial (series) variables and the spatial level to which reference is done.

The purpose of theoretic approaches is to provide answers and optimum solutions to the identified issues, irrespective of the suggested instrument and the used technique. The interest granted to such researches started to gain visibility after the '80s, their practical importance being correlated with the necessity of ensuring balanced development at territorial level and attaining regional convergence.

The period of time for which the analysis of inequalities is realised is very important as territorial development differs on short-term (during the period of a cycle or as answer to a series of unexpected events) from the one on long-term which is influenced by phenomena that can affect the entire capacity of regional development.

Economic development, in general, is a complex process, with different implications from one sector to another, or from one region to another being influenced by factors of higher or lower impact. With respect to regional development, it can be affected by a series of factors that we shall present synthetically hereunder.

An important factor that can influence the development level of a region is the *regional specialisation degree*. Thus, it was found that by specialisation competitive advantages are obtained which in their turn determine positively the development of certain areas. Still, there are opinions according to which regional specialisation contributes to a lesser extent to the emergence increasingly noticeable economic inequalities, in particular of those existing with respect to income

per capita, which are triggered by the differences in productivity, and not necessarily in specialisation.

Another influence factor of one region's development is represented by its production *structure* (economic profile). The differences in the output structure lead to differing answers and reactions both from one area to another, and even from one sector to the other. For instance, in the situation when a region has a marked agricultural character, it is very probable that its development shall be affected by unexpected events (in particular natural ones), being less sensitive to cyclical changes of demand. The predominance of one or another sector can be the reason for fluctuations at macroeconomic level or at the level of other regions with dissimilar specialisations. The variations present into the formation of agricultural incomes trigger changes in the demand or consumption of other industrial activities, or in the tertiary sector.

Also, *the nature or type of the analysed region* constitutes a factor that contributes to regional development or to the emergence of some economic inequalities. In areas which are predominant consumer industries a decline in the incomes level shall be noticed along with one of employment as effect of the national policy objectives. On the other hand, specialised regions in the production of capital goods are more vulnerable in periods of prolonged recession, which attract the diminishment of expectations and investment intentions.

The export is regarded as an important factor contributing to the emergence of regional inequalities, irrespective of the market which is considered (external or international). Thus, regions oriented on export (according to tradition, size or organisation form) are more vulnerable to fluctuations of demand on world market, or to international competition as compared with those oriented on the internal market.

A source for the emergence and increasingly marked territorial discrepancies is also the presence of *costs required to obtain regional output, as well as the level of economic efficiency*. In the situation in which demand decreases, the regions in which companies register low efficiency of output are faced with a series of negative phenomena, resulting from the sub-marginal position of the companies. The companies that make intensive use of the labour force tend to adapt much faster their supply depending on market fluctuations. Characterised by higher competitiveness, these companies can maintain or increase their market share for a longer period of time. On the other hand, over-capitalised companies shall increase competitiveness as effect of costs' pressure being less apt to swiftly adjust to fluctuations of the demand on the market.

"The age" or oldness of the industrialisation process represents, as well, an important factor leading to certain categories of regional inequalities becoming more marked. It is known that economic activities are localised in sectors favourable to entrepreneurial initiatives, in regions that are gradually industrialised or where a diversified structure of industry is given. Such regions are less affected by international factors, in particular due to the lower market share held by the respective industrial sector, but can be influenced by other industrial sectors with problems.

In the last period, a clear factor that is at the basis for the emergence of regional inequalities is triggered by the *innovative potential of the respective region*, by its capacity to create value added especially based on activities of research-development-innovation. This fact presupposes the existence of a local tradition linked to the innovative process or the presence of some important financial resources that support the innovative activity.

As conclusion, the following general influence factors of a more marked development can be identified for some regions as compared to others:

- *Physical factors* –into this category are included infrastructure elements that provide for accessibility to the region. A low potential of the physical factors frames the region into the "structurally disadvantaged" group; examples of this kind of regions are: mountains, insular and coastal areas, etc. Transportation networks favour, in their turn, the emergence and development of economic factors. These factors can explain the large differences between the development of Western areas as compared with those from Eastern Europe;
- *Economic factors* –these factors are analysed and evaluated through the prism of the regional GDP indicator or of the regional GDP per capita, the unequal distribution

determining the structural earmarks at regional level. The change of the New Member States from planned economies into market economies concomitantly with integration into the EU structures led to the creation of a new spatial model of economic inequalities in these countries. Within the socialist system, rapid industrialisation was associated with urbanisations of less developed regions and with the “dispersion” effect of growth between urban and rural areas. Moreover, the high share of employed labour force in agriculture and industry registered a dramatic decrease, fact that triggered unemployment increase, migration, etc.

- *Social factors* –among these factors we can mention: quantity and quality of labour force, entrepreneurship, RDI activity, the politically unstable environment, skilled labour force migration from less developed regions to the developed ones. The analysis of inequalities for this group of factors is realised with a relatively certain difficulty.

Identifying the factors having influence on the regional development and on diminishing economic discrepancies contributes decisively to establishing the optimum measures of regional policy, and finding efficient action levers.

Indicators and analysis techniques

At the basis of the regional inequalities’ analysis are a series of methods and indicators that substantiate in a scientific manner the hypotheses and conclusions presented within spatial research. These spatial analysis methods are focused on *territorial series that are shaped from the row of values of one characteristic ordered in relation to the administrative-territorial units (ATU) to which they belong*⁵. The territorial series operate with complex units such as localities, towns, municipalities, counties, regions, and countries, etc.

The characteristics of the territorial series are the following:

- *Independence of terms* –the specific levels of the various ATU are not mutually conditioned; this feature allows for separate characterisation of each unit by comparing it with another unit or by including it into the total level of the series;
- *Homogeneity of the series* – all terms must have the same economic and social content, the same statistical definition of the sphere of inclusion;
- *Similitude of the terms* – the existence of an identical moment of observation or of a registration period;
- *Variability of the terms* –the combination of essential factors is determined by the specifics of the entire territorial series, with the multitude of random factors that generate the differentiation from one unit to another;
- *Graphic representation* –this is realised with the help of cartography or of a cartho-diagram on the background of ATU maps. Each unit is represented distinctly, in accordance with the qualitative types.

Currently, the realisation of comparative analyses at territorial level and of some territorial-administrative units classifications has a particular importance for the national, community and international level from the perspective of measuring development differences between regions and of formulating adequate strategies.

Indicators

The analysis of inequalities at regional level by using statistic territorial analysis techniques has at the basis a system of specific indicators⁶, corresponding to the nature of terms and pursued purpose.

⁵ Novak, A. (2001), *Statistica*, ISBN 973-8258-50-2, Editura Sylvi.

⁶ In regional analyses can be encountered the following groups of indicators: **A. absolute indicators; B. Indices (ex.: territorial indices, relative gap, territorial concentration coefficient (Gini coefficient, Struck coefficient) and**

Within the European Union, the aspects regarding convergence have triggered the establishment of a set of common indicators and criteria that can contribute to achieving a unitary vision on evaluating the impact of certain community interventions. The selected indicators for evaluating the cohesion and regional development policy are the following: GDP per capita, unemployment rate, life expectancy at birth and educational level. Their use is affected by the availability of data at sub-national (regional) level in the EU.

With the purpose of obtaining a satisfying image on regional performances, the use of some methods can be realised by combining structural indicators: 1. *indicators of physical inequalities* (climate, distance from centre to periphery, accessibility and population density); 2. *indicators regarding economic inequalities* (incomes, industrial activity structure, and economic perspectives, etc.) and 3. *indicators regarding social inequalities* (unemployment, labour force structure, active population, qualification and living standard).

The analysis and interpretation of the above-mentioned groups of indicators provides a global image on the existing situation at territorial level and, by comparison, a highlighting of some regional inequalities.

Analysis techniques

In general, it can be said that regional science “borrowed” from statistics those techniques that can contribute to scientific substantiating of some results. Within regional studies, the dispersion parameters (variance) are the *most used because they can synthesise in a scalable manner the information about inequalities in distribution*. This fact presupposes that each evaluation of aggregated inequalities contains information about distribution, fact leading sometimes to different outcomes (therefore, it is important that for empirical analyses to verify the robustness of conclusions) (**Annex 1**).

With respect to the analysis of regional convergence, there are a series of restrictions regarding the use of statistical techniques which are determined by the use of some non-homogenous series of calculation and which can lead to unrealistic outcomes and affecting the perception about the convergence trend (G. Petrakos, 2005). The alternative is to attach different values to each observation, which would reflect their relative contribution. For instance, in the case where we have as variable the regional income (GDP), the indicator can be weighted with the population number from the respective territory. In some situations, the statistical data and information can be asymmetric, fact leading to difficulties in computing the respective indices.

The trends presented within regional analyses are based on the use of estimation techniques of non-parameters’ averages which allow for presenting some functional particularities. In this instance, there is a series of advantages determined by the generalities or flexibility associated to the approached parameters.

The evaluation of regional imbalances is realised by defining the statistical values corresponding to the computation formulas. From this point of view, taking into account some size differences between the territorial levels can lead to a series of conclusions regarding existing trends.

In conclusion, it can be said that there is permanent concern of economic science for estimating and evaluating the dynamics of territorial entities, considering the existing conditions and the reported periods of time. The regional analysis models pursue in particular to explain the reasons leading to the emergence of economic and social inequalities between regions and within the same region, with the purpose of identifying best actions for counteracting the effects of their emergence and prominence.

CONCLUSIONS

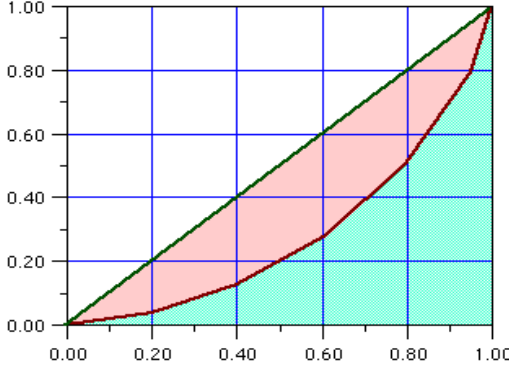
Used both by analysts, theoreticians and practitioners, the concept of disparity expresses the differences identified with the help of some adequate mathematical techniques using specific indicators or indices. This concept presents several facets being accompanied by other elements that support it: convergence, polarisation, agglomeration, concentration, dispersion, etc.

In general, the theoretic approaches regarding regional convergence have focused their attention on the *catch-up process: less developed regions make significant efforts to catch-up with rich regions*. The main identified trends within this process – agglomeration and dispersion – are analysed and interpreted within some recent regional approaches: *the theory of endogenous growth, the new economic geography and the institutional theory* (W.R. Scott, P. Dimaggio, W. Powell).

The theories regarding regional inequalities and convergence indicate a relative variety of techniques and analyses that can reflect this fact. The integration of economic methods in spatial analyses highlights the effects of spatial dependence and of heterogeneity on convergence. It can be stated that regional science “borrowed” from statistics those techniques that can contribute to scientific substantiation of some outcomes and, in particular, to identifying the trends registered in the convergence process within a community of states.

Annex 1: Statistical-mathematical techniques and methods of regional analysis

1.	Dispersion parameters (variance, scatter)	Amplitude (range of variation, ω) - has a clear meaning and is determined very quickly. $\omega = x_{\max} - x_{\min}$
2.		Mean deviation - the arithmetic mean of the absolute deviations of the observed values of the variable from their arithmetic mean. It can be calculated for a series of individual values or one of frequencies. $e_{\bar{a}_x} = (\sum a - \bar{a}_x)/n$
3.		Mean square deviation (standard deviation, σ) - the square root of the arithmetic mean of the squares of the deviations of the values observed relative to their arithmetic mean. It can be calculated for a series of individual values or one of frequencies. A higher value implies a higher intensity of the variation of the variable. $\sigma = [\sqrt{\sum (a - \bar{a})^2}]/n$
4.		Dispersion (variance) - is equal to the arithmetic mean of the squares of deviations. $\delta^2 = [\sum (a_i - \bar{a})^2]/n$ The notions of variance and mean squared deviation are fundamental; they are explicitly or implicitly found in almost all the developments of the statistical method.
5.		The coefficient of variation (v) represents the ratio between the mean squared deviation and the arithmetic mean. This coefficient expressed as a percentage is the most widespread measure of relative dispersion. $v = \sigma/\bar{a}_x$
6.		Gini's average difference - represents the arithmetic mean of the differences in absolute value, formed by associating the values of the variable two by two in all possible ways, including with themselves. $G = \sum \sum p_i p_j a_i - a_j /\mu$
7.	Parameters of Distribution	Yule's coefficient - the ratio between the difference of the quarter's deviations and their sum.
8.		Pearsonian coefficients (the coefficient of asymmetry) - the difference between the mean and the mode divided by the mean squared deviation (sk notation is related to the term skewness which means oblique, used by Pearson for the name of asymmetry. A symmetrical distribution has zero asymmetry). $sk = (\bar{a}_x - M_0)/\sigma$
9.		Pearson's curves - represents 12 frequency distributions developed by K. Pearson, called type I, type II and type III distributions. The differential equation is as follows: $df/dx = (x-a)/(b_0 + b_{1x} + b_{2x} + \dots)$
10.		Concentration curve (Lorenz-Gini curve) - represents the inequalities between the relative parts assigned to the classes in the distribution of the global values of the observed variable. The Lorenz-Gini concentration curve is constructed by joining the coordinate points, being inscribed in a square with the side equal to 1 or 100%, the surface defined by the concentration curve and the diagonal of the square being called the concentration surface. The more the concentration curve deviates from the diagonal of the square, the larger the concentration surface, and the inequalities are larger, and the concentration is stronger.

		
11.		<p>Concentration coefficient (Gini's Index) - is defined as the ratio between the concentration surface and the area of the square, but since the area of the square is equal to 1 or 100%, the value of the index is dimensionless, independent of the units of measure of the studied variable. Its value ranges from 0 to 1 - the closer it is to 1, the higher the concentration.</p> <p>$G = \text{the concentration area} / \text{area of the triangle formed between the diagonal and the curve}.$</p>
12.	Histogram	<p>Histogram - is a diagram that summarizes the distribution of data. Starting from a division into class intervals, the histogram is a set of rectangles based on class intervals and areas proportional to the number of observations belonging to class intervals. Thus, the height of a rectangle is calculated as the ratio between the number of observations in the class interval and the length of the respective interval. The vertical axis of a histogram is thus a density scale. In the construction of a histogram, the convention of the extreme point is important.</p> <p>Probability Histogram - Probability is used instead of relative frequencies.</p>
13.	Atkinson Index	<p>It is derived from the utilitarian function of social welfare and allows the quantification of welfare loss associated with income dispersion (A.B. Atkinson, 1970).</p>
14.	Herfindahl-Hirschman Index	<p>It is considered to be very frequently used in the analysis of regional inequalities, measuring the degree of concentration of some variables (GDP, employees, population, etc.). Its value increases with concentration.</p>
15.	Theil Index	<p>It measures the existing inequalities in the distribution of variables according to the following formula:</p> $T = 1 / n \sum (x_i / \bar{x} * \ln x_i / \bar{x})$ <p>where x_i is the variable x in territory i, \bar{x} represents the arithmetic mean of the variable x and n the number of regions.</p>
16.	The degree of spatial association	<p>It is calculated for two activities if they have close specializations, the calculation formula being proposed by S. Florance:</p> $DAS_{(j,g)} = 1 - 1/2 [\sum_i x_{ij} - x_{ig}]$
17.	The coefficient of industrial specialization	$CS_i = 1/2 \sum_i x_{ij} - X_j/X \cdot 100$
18.	Kernel variable method	<p>It approximates the inequalities using a simple estimator (such as the nearest neighbor method, the orthogonal series estimator, etc.).</p> <p>In this function, the most important moment is the selection of the parameters. The distribution density is calculated according to the formula:</p> $f(x) = 1/h \sum p_i K[(x-x_i)/h], \text{ where } i \text{ belong } (1, \dots, n) \text{ and } K \text{ is Kernel function which integrates the parameters.}$
19.	Quah Method	<p>t proposes an analysis of the distribution of regional income per inhabitant during the period t, associated with the probability ϕt, where $\{\phi t, t \geq 0\}$.</p>
20.	Indicator of the structural	<p>It measures the relative importance of the changes registered in the structure of the economic activities between two considered periods:</p>

	stability of the region	$SS_i = \frac{1}{2} \sum_j x_{ijt}' - x_{ijt}(1+g_j) / \sum_j x_{ijt}'$
21.	Multicriteria hierarchy	<p>It is made on the basis of several relevant criteria, selected for the purpose of drawing up regional rankings (rankings). The calculation algorithm is as follows:</p> <ul style="list-style-type: none"> - selecting the relevant indicators used in the elaboration of the multicriteria ranking; - choosing the unit of measurement of the comparison result and elaborating the partial rankings with the help of each individual indicator; - aggregation of partial rankings using a single indicator; - interpretation and capitalization of the results obtained from the multicriteria hierarchy.
22.	Ranks Method	<p>One rank is assigned to each region, successively, according to the indicator included in the analysis, the unit with the highest qualitative performance obtaining rank 1. By summing the ranks, each unit obtains a score. The unit with the lowest score is the most efficient from all points of view included in the multicriteria analysis and obtains the rank 1. This method is relatively easy to use, obtaining generally correct information. The disadvantage is that the method doubles the levelling of the variable size of the differences between units by replacing them with ranks. The higher the number of criteria, the greater the possibility of obtaining equal scores, difficult to differentiate.</p>
23.	The distance method relative to the maximum performances	<p>This method calculates the distance of each unit to the maximum level reached within the community. The UAT is placed at certain distances from the maximum variant, measurable distance by relative coordination sizes smaller than 1. For the use of this method, the hierarchical variables must be defined so that the maximum performances have the same positive significance; the relative distances observed can sometimes be aggregated to a positive performance, sometimes to a negative performance.</p>

Source: Processing after the Small Statistical Encyclopedia (M. Iosifescu, C. Moineagu, V. Trebici, E. Ursianu), Scientific and Encyclopedic Publishing House, Bucharest, 1985.

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